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A REVISED PROGRAM OF INDUSTRIAL ARTS IN THE NINTH AND TENTH GRADES OF THE SCHOOLS IN WORCESTER, MASSACHUSETTS

SERVICE PAPER

Submitted by

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TABLE OF CONTENTS

CHAPTER PAGE

LIST OF FIGURES

LIST OF PLATES

LIST OF TABLES

CHAPTER I

THE PURPOSES AND METHODS OF THIS STUDY

The Problem

Purposes of the study. -- This study was written to achieve two purposes: (1) to report accurately the present industrial-arts facilities in the senior high schools of the city of Worcester and (2) to report needed changes and additions.

Need for the study. -- An expansion of the industrial arts program is desirable in the light of changing times because recent years have shown a change of attitude in respect to the industrial-arts activities. The city of Worcester has one industrial-arts center which provides training for students from the four public high schools. Figure 1 which shows the floor plans of this building clearly illustrates the following defects:

1. Lack of adequate space for individual shops
2. No opportunity for expansion
3. No provision for lecture rooms
4. Inadequate storage facilities

The plan of procedure. -- This study will be divided into four parts:

1. An inventory of present facilities will be shown

Figure 1. Floor plans of the Industrial Arts Center of Worcester, Massachusetts.

by pictures and drawings of the various shops and statistics from the school department.

2. Resume of the opportunities found in Worcester industries will be obtained by presenting an overall picture of the industrial set up.

3. Recommended shop layouts and equipment for the expansion will be obtained from catalogs, handbooks, and courses of study from industry and from secondary schools throughout the country.

4. Summary and recommendations.

The Growth of Industrial Education in the United States

Period of home industry.-- A century ago, Americans constructed in the home or local community practically all the industrial products needed. Houses were fashioned of native lumber crudely finished, with furniture roughly hewn, but serviceable. The rugs, draperies, and textiles were spun in the home. Tools were crudely made from iron by the local blacksmith. Transportation facilities were definitely limited.

Present industrial conditions.-- Today, conditions are far different. The food is delivered to the door ready to serve. Houses are built completely furnished and ready to use. The radio, the airplane, the stream-

lined train, and the telegraph system have contributed immensely to reduce the size of the world. Industry has been taken out of the home and placed in the factory.

The changing secondary school. -- Statistics show that high school enrollment has doubled each decade since 1890. With this influx has come the necessity for providing a richer and general course than previously offered. The broadening of the secondary curricula beyond the traditional liberal arts was necessary. The severance of many people from home industry and the loss of opportunity for creative expression through manipulative work were felt by all.

In 1879, St. Louis, Missouri, opened a Manual Training School.[1/] The objective was to train the head and hand to determine whether or not the pupil was well fitted to become a mechanic. Meanwhile, Sweden and Russia were doing some important work in the development of industrial education. By 1906 the National Society for the Promotion of Vocational Education was formed. At the Sprayer School in New York City, New York, Frederick Bonser and James

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1/ Charles Alpheus Bennett, History of Manual and Industrial Education 1870 to 1912. The Manual Arts Press, Peoria, Illinois, 1937, p. 402-463.

Russell were developing the general aspect of the Manual Training movement. It was through the efforts of these two men that industrial-arts theories began expanding. Today,[2/] industrial-arts is defined as a phase of general education that concerns itself with the materials, processes, and products of manufacture, and with the contribution of those engaged in industry.

A recent survey of the "School Shop" publication disclosed the fact that 74% of the school systems reporting are planning expansion of their facilities in the immediate future.[3/] Over a billion dollars will be spent in the next few months in this expansion movement. The United States Office of Education estimates that five billion dollars will be needed for the modernization of old buildings and the erection of new ones, during the coming five year period.

2/ Bulletin 1937, No. 34, United States Department of the Interior, Office of Education, p. 1.

3/ Shop Planning Portfolio, School Shop, (June, 1946) p. 7.

The Industrial Background of Worcester, Massachusetts.

Worcester, key to New England.-- With a system of production that is uniformly active throughout the year. Worcester has been called the largest industrial city not on a waterway in America. The city presents a typical cross section of American life. The north, east, and south sections of the city contain most of the industrial plants. The northwest is strictly residential while the northeast, east and south house the majority of the industrial workers.

The Department of Labor and Industries reported[4/] that according to data collected with the census of manufacturers for the year 1945, the total number of manufacturing establishments in this city was 511, an increase of twenty units over the previous year. In an interview with the head of the division of industries at the local Chamber of Commerce, the writer learned that during the past year nineteen new industries have been introduced to this city.

4/ Census of Manufacturers, 1945, City of Worcester, Massachusetts. Commonwealth of Massachusetts, Department of Labor and Industries, Division of Statistics, Boston, Massachusetts. Folio: Manufacturers 1945 - No. 39, p.5.

Opportunities in Industry.-- A study of the United States Census[5] revealed the information shown in Table 1.

Table 1. Analysis of Labor Supply (1940 U.S. Census)

City of Worcester	Men	Women	Total
Labor Supply	57,341	24,099	81,440
Manufacturing	23,087	6,151	29,238
Trans. and Comm. and Public Utilities	3,321	484	3,805
Trade	9,111	3,723	12,834
Professional Services	1,555	3,526	5,081
Finance, Insurance and Real Estate	1,361	879	2,240
Other Types of Work	7,114	1,644	8,758
Seeking Work	9,053	3,501	12,554
Estimated Unemployed July, 1946	8,000	600	8,600

Known as the "City of Diversified Industries",[6] Worcester has establishments with invested capital of $223,000,000 and normal annual production valued at $185,000,000. Wartime production rose to about $400,000,000 a year. This city is one of the world's

5/ Sixteenth Census of the United States, Department of Commerce, Washington, D.C., Vol. 3, p. 508-512.

6/ Worcester, Massachusetts - Folio published by the Chamber of Commerce.

machine tool centers, has the world's largest abrasive plant, and has a number of plants known the world over as leaders in their fields.

In an interview at the local United States Employment Agency, the writer learned that the filing system of that organization was based on direct industries rather than on occupational lines. Bulletin[7/] supplied by them contained the following list of products manufactured in the city during the year 1945. Only the most important products were considered:

1. Steel and rolling mill products
2. Wire and wirework
3. Boots and shoes
4. Leather and leather belting
5. Tools
6. Screw machine products
7. Printing and publishing
8. Street cars
9. Plastics
10. Carpets and rugs
11. Structural and ornamental metal work
12. Envelopes
13. Machine tools
14. Abrasive wheels and stones
15. Textile machinery
16. Iron and steel forgings
17. Bakery products
18. Woolen and worsted goods
19. Firearms
20. Foundry and machine shop products
21. Foundry and pressed metal products
22. Knit goods

7/ Census of Manufacturers, 1945, op. cit., p. 5.

An analysis of the above shows that the following trades are represented: Textiles, Metal, Printing, Food, Leather Working, Chemical and Mechanics. Any industrial-arts program claiming to offer exploratory, tryout or guidance values to pupils is not fulfilling its obligation unless the majority of these types of work are represented in the shop by as many of the elementary processes of construction as can be provided.

If industrial-arts work is to meet the objectives which are established for it by general, as well as industrial-arts educators, it is necessary that an opportunity be given the individual to participate in as many different types of work as possible within the facilities and limitations of the school curriculum.

Industrial-arts is that phase of education which is concerned with materials, products and problems of industry and their contribution and significance in relation to our daily living.[8/] If we are to meet this concept of education, it is necessary that pupils be given a good chance to work with as many of the raw materials which go into the construction of the industrial products as possible. Practically

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8/ Sylvan A. Yagu, "Shop Planning in the High School" Industrial Arts and Vocational Education (March, 1947) p. 87-95.

every member of our industrial democracy is using articles constructed from metal, fibre, lumber, paper and chemical substances. They need to know some of their properties and how the finished product was obtained. Table 2 shows a list of industries in Worcester which cover the above materials.[9/]

Table 2. Principal Data Relative to Manufacturers in the City of Worcester, Massachusetts

Industries arranged in the order of value of product.	Number of Establishments	Average Number of Employees
Machine tools	9	5,345
Foundry and machine shop products	35	2,448
Wire	5	2,260
Boots and shoes	10	2,077
Textile machinery	15	1,916
Screw machine products	10	2,170
Woolen and worsted goods	15	1,604
Stamped and pressed goods	10	1,124
Machine tool accessories	12	927
Bread and bakery products	49	775
Printing and Publishing	33	484
Wirework	6	467
Tools (not including edge tools)	5	241
Cotton goods	8	323
Wool shoddy	6	61
Boot and shoe cut stock	4	132
Clothing	16	429
Corsets and allied garments	6	368
Electroplating	8	227
Furniture	14	153
Other industries	216	20,528

9/ Census of Manufacturers, 1944, City of Worcester, Mass. Commonwealth of Massachusetts, Department of Labor and Industries, Division of Statistics, Boston, Massachusetts. Folio: Manufacturers 1945 - No. 38, p. 5.

CHAPTER II

A DESCRIPTION OF THE PRESENT OFFERINGS IN INDUSTRIAL ARTS WITH SUGGESTIONS FOR IMPROVEMENT

Inventory of the Present Facilities in the Senior High Schools

Industrial-arts classrooms available in high schools.

Worcester has four public senior high schools: North, South, Classical and Commerce.

The latter two schools are located in the center of the city while North and South are located approximately one mil in their respective directions from the center. From a physical standpoint, the schools differ considerably.

Table 3, Page 12, gives a summary of the shop capacities of the four high schools.

Table 3. Present Industrial-Arts Shop Facilities in the Four Public High Schools in Worcester.

Schools	Rooms					
	Mechanical Drawing		Woodwork		Radio	
	Number	Capacity	Number	Capacity	Number	Capacity
Commerce	2	144 pupils each			1	140
Classical	1	120 pupils				
North	2	120 pupils each				
South	2	120 pupils each	1	96 pupils each		
Total	7	888	1	96	1	140

School (male) and shop enrollment in the high schools.

A summary of the school enrollment (male) and the industrial arts shop enrollment is given in Tables 4 and 5.

Table 4. Male School Enrollment, Grades IX to XII inclusive, in the Worcester High Schools.

Schools	Enrollment Grade 9	10	11	12	Total
South	232	118	104	57	505
Classical	70	146	110	78	404
Commerce	162	242	229	173	802
North	158	161	128	97	544
Total	622	667	270	399	2259

The four high schools also send pupils to the industrial arts center for woodworking and mechanical drawing.

Figure 1, page 2.

The capacity for this center is approximately 400 pupils per term. It is located on the second floor with an electric appliance company on the first floor and an electroplating company on the third floor. The floor space is rented and is not the property of the city.

The location is very poor because the building is in a congested area, with the police and fire headquarters close by. Every inch of floor space is used and there is no chance for expansion.

Table 5. Shop Enrollment, Grades IX to XII inclusive, in the Worcester High Schools.

Schools	Enrollment				
	Grade 9	10	11	12	Total
South	232	118	104	57	505
Classical	70	146	110	78	404
Commerce	162	242	229	173	802
North	158	161	128	97	544
Total	622	667	270	399	2259

On pages 16, 18, 20, 21, 23, 24, 26, 28, 35, 40, 51, 56, 59, and 63, are photographs and floor plans of the various shops within the industrial-arts center. Poor conditions that exist will be listed.

All photographs were taken and developed by a student who had chosen photography as his hobby. It is well to note

that this boy is considered a so-called "problem student".

In the present shop layouts, it must be understood that with a meager physical set up, the department has done remarkably well to plan and lay out these respective shops. The present shops have been laid out and rearranged over and over, and the present set up seems the best solution. As in many other communities, industrial arts in the secondary schools of this city is laboring under the strain of an inadequate physical arrangement which prevents it from providing well-equipped and ideal shop planning.

The woodworking shop. -- This shop accommodates students taking woodworking I and II. Plate 1, page 16, and Figure 2, page 18, will clearly illustrate the following faulty conditions: 1. Dark, dirty walls absorb a great deal of the light entering the room. Working positions directly facing windows are generally not satisfactory, because of a constant glare on the pupil and his work. Although natural light is best, there is no method of controlling such light. 2. Pupil work-stations are so placed that interference from aisle travel and adjacent workers is at a maximum. Under the circumstances, this is the only possible solution for accommodating 24 students.

Plate I. -- Woodwork Shop

3. The size of this workshop is 38' x 37'. There are 24 benches which take up 288 square feet, plus floor space for tables and cabinets which leaves only 27 square feet in floor area per pupil.[1/] The area of the shop shall be determined by the general rule of allowing a minimum floor area or at least 50 square feet per pupil.

4. The overhead lighting system is inadequate. Good general lighting shall be provided to an intensity of at least 3 foot candles at bench height in all areas. The present system provides approximately 1/4 foot candle light. All lamp bulbs are visible, which is considered poor practice.

5. The present method of controlling ventilation is improper. A circulating washed air system for the workshop would be most desirable from the point of view of health and maintenance.

6. The floor plan, Figure 2, page 18, clearly shows that there is no possible chance for expansion within this present area.

7. The efficiency of this shop or any other shop is greatly impaired by the lack of proper storage space, such as: supply rooms, lumber racks, cupboards, and cabinets in which to house

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1/ Bulletin 1939, No. 331, Industrial Arts for Secondary Schools, Department of Public Instruction, Harrisburg, Commonwealth of Pennsylvania.

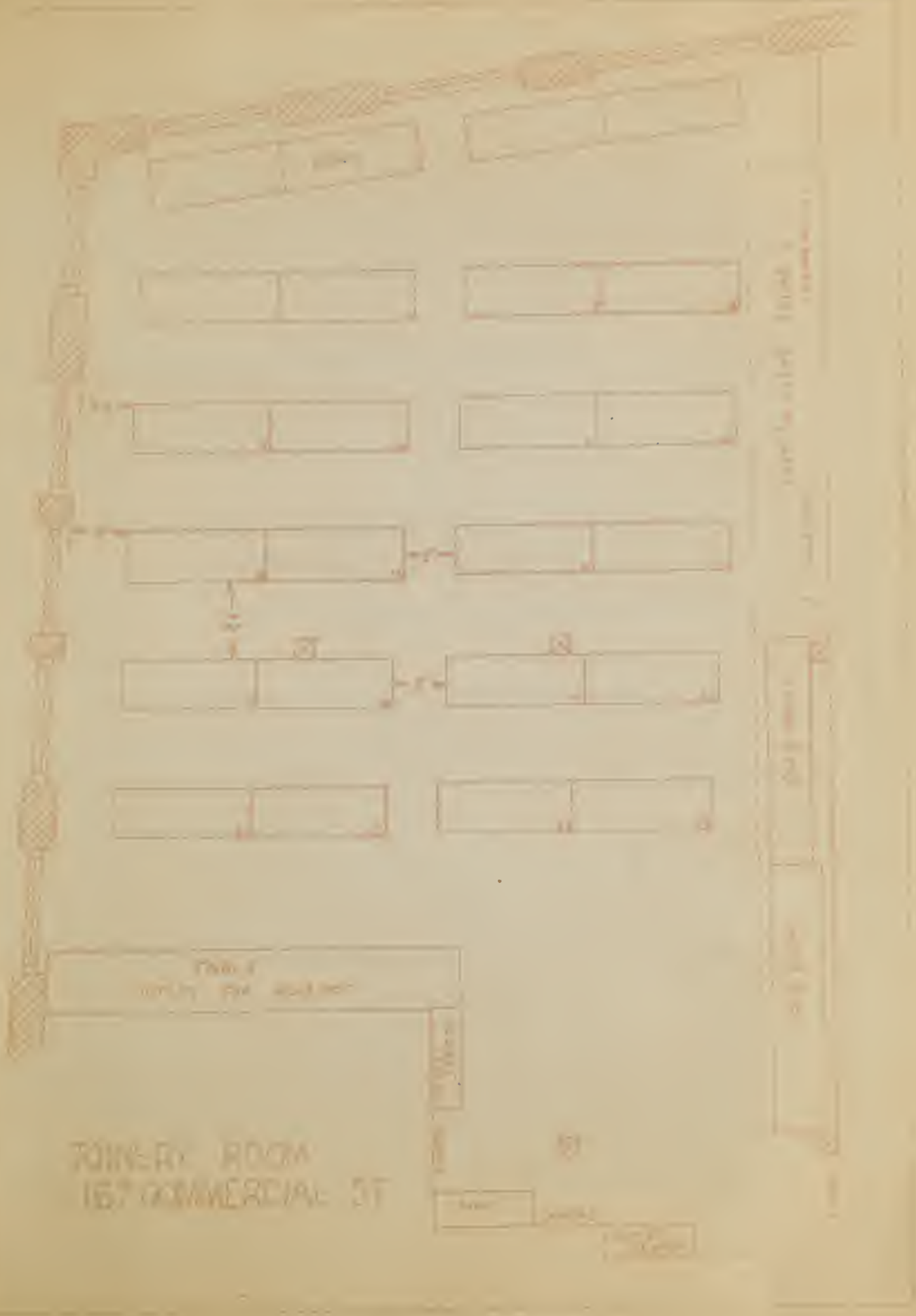

Figure 2. Floor Plan of the Woodworking Shop

supplies and projects.

8. Where noisy machinery is in constant operation on the upper floor, there is no noise absorbing material used in the ceiling.

9. This shop is located on the corner of two busy streets, and there is constant distraction by the noise of passing traffic.

The mechanical drawing room.-- This is the only provision made for mechanical drawing classes. Plate 2, page 20, and Figure 3, page 21, shows that the following conditions exist:

1. The outstanding fault in this shop is poor lighting facilities. There is improper provision for regulating the direct glare from the windows. Poor lighting causes fatigue and results in poor work.

2. Drawing tables are crowded together and there is insufficient area in which the student might work comfortably. Aisles are too narrow and a great deal of interference is caused by passing traffic.

3. A shop of this type should be free of dust and dirt, but dirt from the upstairs shop seeps through floor and ceiling. There is no provision for noise absorption in walls or ceiling.

Plate 2. -- Mechanical Drawing Room.

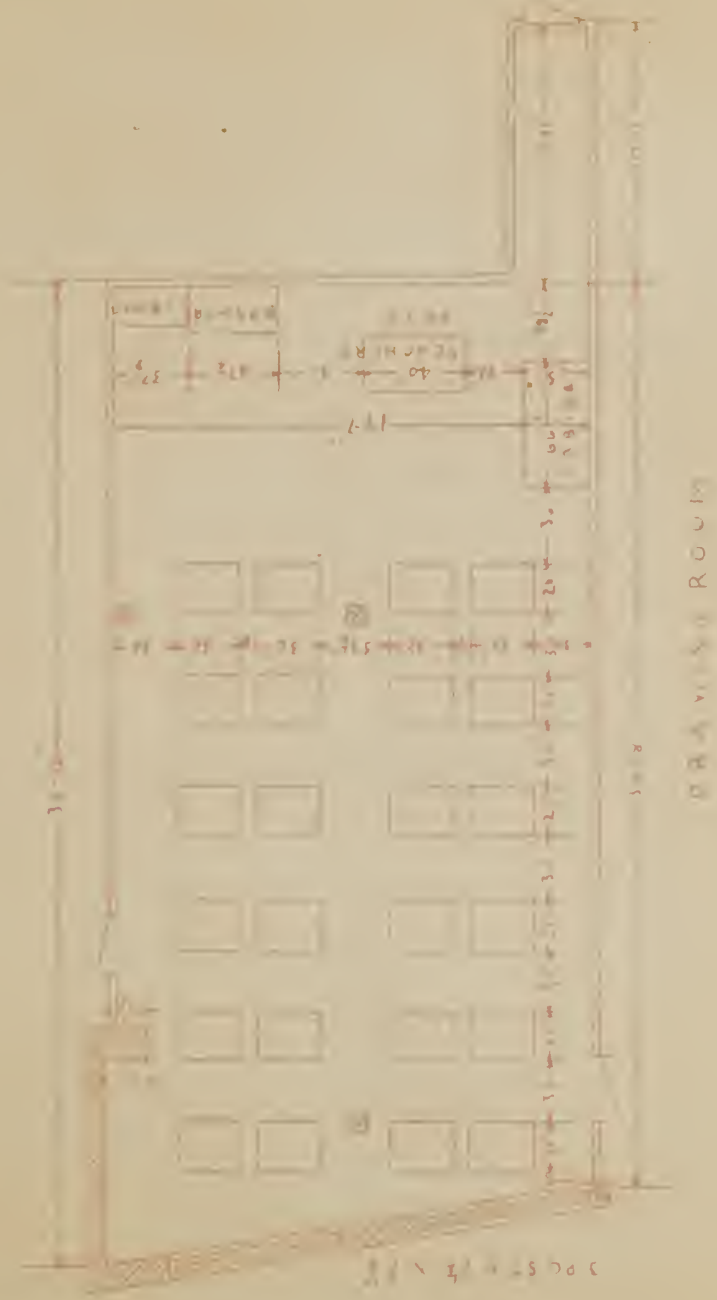

Figure 3. Floor Plan of the Mechanical Drawing Room.

4. With limited window space it is evident that there are obstructions in the line of light.

5. The walls and ceiling, not only of this room, but of all rooms, are dark and dirty. Pastel colored walls are desirable, properly installed fluorescent lamps are ideal.

6. Figure 3, page 21, clearly illustrates the lack of any possibility for expansion by way of additional benches or blueprinting equipment.

7. Figure 3 also shows that this room is adjacent to the mill room. When our power machines are in operation (and the machine on the above floor is in constant operation) it is impossible for the student to hear the instructor.

Wood turning and pattern making shop.-- This shop accommodates pupils taking Shop III and IV and is illustrated in plates 3a and 3b, shown on pages 23 and 24. Photographs clearly illustrate the following conditions:

1. In work of this type, each student should have the maximum working space. The lathes are too close together. A working area of 37 square feet per pupil is insufficient in work of this type. Sufficient working space around each machine must be provided for safety and efficiency.

2. The instructor should be able to observe the students when they are working, but the whole shop is not visible to

Plate 3a. -- Woodturning Shop.

Plate 3b. -- Woodturning Shop.

him because of the antiquated belt drives and other obstructions that exist.

3. A great deal of demonstration on the part of the instructor is required here, but there is no provision for a demonstration area. Only those who are able to get around the machine are able to observe while the others have to strain in order to see.

4. Sufficient storage space is not provided, and the efficiency of this shop is greatly impaired by the lack of storage facilities, such as supply rooms, cupboards, and cabinets.

5. Overhead shafts and belting are antiquated, and a great deal of the time has to be spent by the instructor in the repair and upkeep of same.

6. In lathe work, good eyesight and lighting are important factors. The assumption that dim lighting is restful to the eyes does not apply to the shop. Under the existing conditions, only those students in front rows of machines benefit from the natural lighting. The students in the rear rows have to carry on as well as they can.

7. No provision is made for finishing projects. All shellacing and varnishing have to be performed in this same room where there is a great deal of dust and dirt.

Plate 4a. -- Millroom.

The millroom.-- This shop accommodates students taking the advanced courses in woodworking and is illustrated in plates 4a and 4b, shown on pages 26 and 28. The photographs clearly illustrate the following conditions:

1. In a shop of this type there is much dangerous equipment. Constant supervision is required on the part of the instructor, but it is apparent that many obstructions lie in the line of vision.
2. A great deal of dust is created by this type of work, and there is no provision for a dust collecting system.
3. Sufficient working space should be the rule for power machines, but due to the physical layout of the shop, it is impossible to supply the maximum.
4. If any school shop is to be sound-proof, it should be one of this type. The circular saw and planer, when in operation, can be heard throughout the whole floor.
5. The shape of the shop is irregular. No matter where the instructor is located, all parts of the shop are not visible to him. Students operating machines require constant supervision.
6. Pupil work-stations, both on machines and benches, are in interference with adjacent workers and aisle travel. Alteration of these conditions is impossible.

Plate 4b. -- Millroom.

7. No washing facilities are provided within this or any of the shops. From administrative reasons, it is considered poor practice to have only one wash station which results in ganging and crowding.

8. Precision equipment such as: lathes, milling machines, drill presses, etc., should be given preference in location with reference to natural light. In the present setup, the maximum amount of light has to be supplied by artifical means.

Suggested Floor Plans and Equipment for Shops in the Industrial-Arts Program

Industrial-arts in general education.-- Modern industrial-arts courses have a real contribution to make to general education, if given the opportunity.[2/] Industrial arts contributes to general education by: (a) developing an interpretation of design and quality in manufactured products; (b) providing practice in the use of materials and tools for recreation and home utilization; (c) sampling a variety of industries through advanced courses, in prepara-

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2/ United States Department of Interior - Office of Education Bulletin No. 34 - 1937, p. 61.

tion for entrance as a beginner into the skilled trades or into college courses in engineering and architecture.

The writer has proposed additional shop courses, floor plans, and lists of necessary equipment and supplies for the physical reconstruction of the present industrial-arts program. If they serve to stimulate planning, they will accomplish their purpose. The various units are proposed in an effort to provide broad exploratory experiences and standards of skill development in terms of the individual's capacities.

Planning for improvement of industrial-arts shops.--In planning new shops one must keep in mind the above mentioned contributions as a constant guide. It is well to note that the present arrangement of the school shops should serve as a guide and not the rule. Industrial-arts shops throughout the state have been arranged in many different ways. Local conditions and needs prevent many standards from being followed because of the undesirable physical plans of the rooms. Nevertheless, there are many elements common to all shops and contributions to standardization that will bring about beneficial results. The following generalizations in shop planning are to be

considered.[3/]

1. Each shop should be uniquely planned for the educational function it is to serve.

2. Each room should be arranged, decorated, lighted, heated and equipped so that it has a definite relationship to the rest of the building.

3. Provision should be made for adequate work space for each student. The average floor space of industrial-arts shops is fifteen hundred feet. A shop of this size will accommodate twenty-four pupils.

4. Ceilings should be not less than eleven feet in height and all work shops should be ceiled with a material of a high coefficient of absorption.

5. There should be an abundance of well distributed lighting. Care should be taken as to the type machines to be installed. If there are heavy duty machines, precaution should be taken so that proper electrical provisions are made. Red pilot lights should be installed near all main switches.

6. A main reference library should be provided to enable students to develop and plan their ideas. A display of

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3/ Industrial Arts for Secondary Schools, Commonwealth of Pennsylvania, Department of Public Instruction, Harrisburg - No. 331, p. 111-113.

conditions.[1]

[illegible]

[illegible]

[illegible]

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[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

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[1] [illegible]

current books and magazines should be made available to students.

7. The shape of the workshop is important. In general, it should be rectangular, and irregular shaped workshops such as "U" and "L" should be avoided whenever possible.

8. A teaching center with a permanent seating arrangement should be provided. This center might also serve as a moving picture center and be made available to all shop teachers. A workable arrangement could be made by the various instructors for the use of such a center.

9. Provisions should be made for placement and follow-up of students completing their courses. Contacts should be made with industry to note progress and to offer further assistance if necessary.

10. Student lockers are best distributed about the workshop rather than concentrated in a single area. Crowding and ganging is thus avoided.

11. Tools that are to be in constant use should be in plain sight for instant checking.

12. Fire extinguishers of the right type should be readily available.

13. Provisions should be made for steel cases and waste containers for inflammable materials.

14. Machines should be of the unit type in order to

provide maximum efficiency and safety.

15. The floor should be adapted to the type of shop, avoiding concrete whenever possible.

16. Provisions should be made so that large amounts of lumber supplies and materials are not openly accessible to pupils.

17. In cities with large populations, there should be at least one comprehensive general shop besides the various units. This shop should be divided into sections containing such work as metal, woodwork and home repair. A shop of this type would be an asset to those who can only devote one semester to work of this nature.

18. The shop should be constructed, equipped and arranged so as to insure: (1) instructional convenience, (2) safe and economical operation, (3) ease of administration, (4) maximum educational values to schools.

19. Space should be provided for storing projects under construction and after completion.

20. An area should be allocated for planning and designing.

21. Walls, ceilings and equipment should be painted in a suitable color scheme.

General woodworking shop.-- This shop has accommodations for twenty-four pupils and will include woodworking

from grades IX through XII. In the general woodworking course, the following types of work should be taught: elementary woodworking, cabinet making and repair, mill-room practice, woodturning and wood finishing. A pupil spending a short period of time in this course would be given instruction in the use and care of hand tools used in cabinet making and carpentry trades. A pupil taking a longer course would make a more intensive study of the fields included within the shop.

Figure 4, page 35, shows the proposed arrangement of the general woodworking shop. Most of the machine equipment has been placed at one end of the room to provide direct supervision for power equipment. The area occupied by the benches is devoted to complete handworking equipment, including bench work and general tool operations. Ample space has been provided for supply and equipment storage.

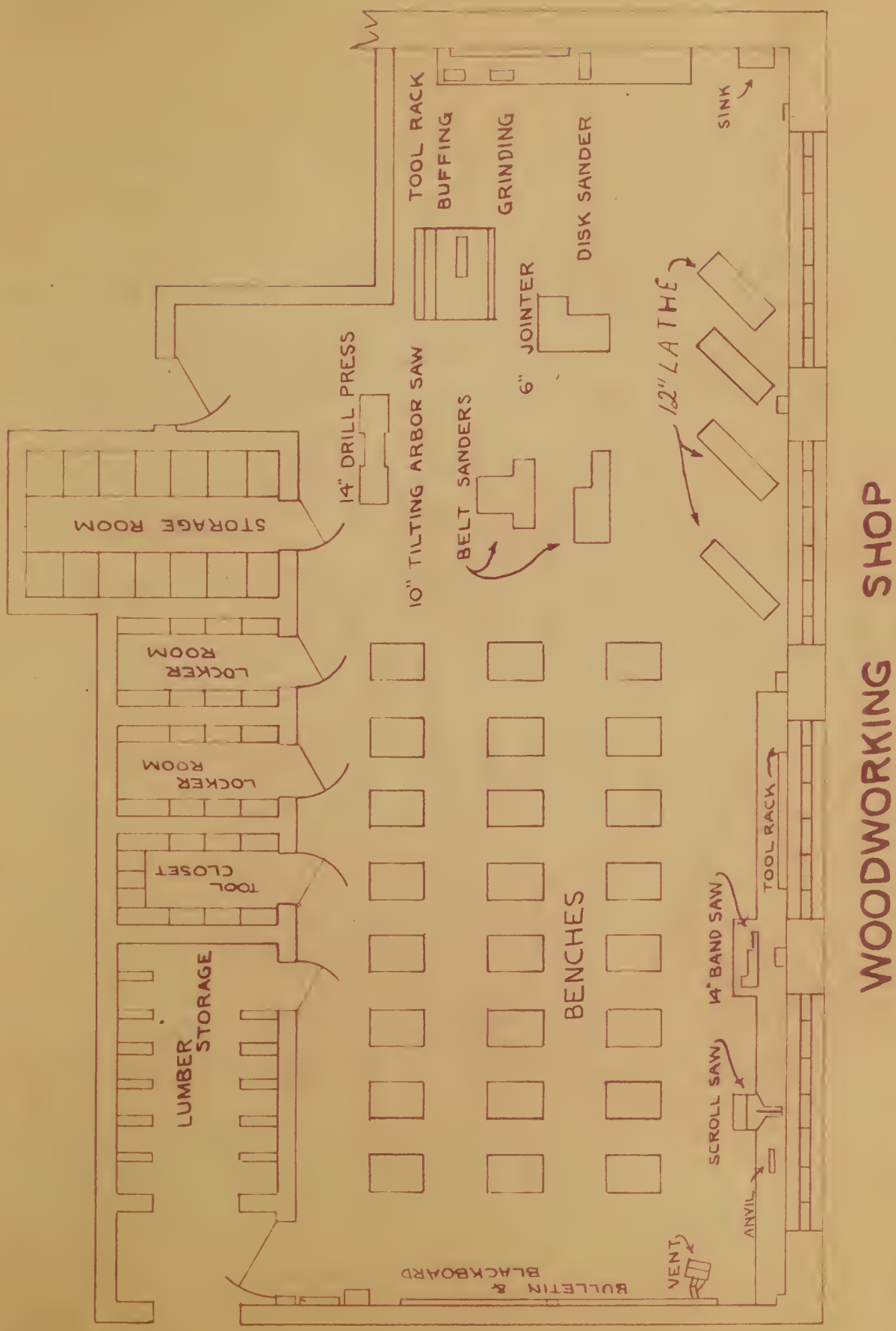

Figure 4 - Proposed Floor Plans for Woodworking Shop.

Following is a list of equipment necessary for a shop of this type:

Name and Description	Quantity	Approximate Unit Price
Band Saw, 14", complete with stand and motor, universal type, operating on AC and DC, 110 volts. 6 blades (variable sizes)	1	$125.00
Drill, electric, one half inch capacity, Overall length 16-5/8 inches. Complete with stand and motor, operating on AC and DC, 110 volts.	1	110.00
Glue Pot, electric, two quart capacity, Thermostat heat control.	1	28.00
Grinder, motor driven. Two one-inch face oilstone wheels. One coarse and one fine grain.	1	65.00
Jig Saw, 24" clearance, variable speed motor drive, table tilts to 45 degrees Complete with stand and 2 dozen variable sized blades.	1	59.50
Jointer, eight inches; table length, four feet; height, 31½ inches. 3/4 H. P. Three knives on cutterhead, adjustable fence tilting to 45 degrees. Speed 3600 R.P.M.	1	185.00
Lathe, woodturning, 38" between centers, direct motor drive. Complete with all standard equipment.	4	150.00
Saw, power, tilting arbor, direct motor drive; including two rip saws, two cross cut saws and one six-inch dado head. Complete with motor and all necessary guards	1	210.00

Name and Description	Quantity	Approximate Unit Price
Large Equipment		
Benches, woodworking, single, six small drawers, screw vises	24	$ 90.00
Rack, lumber and project storage To be constructed with necessary lumber (yellow pine)	1	50.00
Small Equipment		
Bevel, T, 8" blade.	10	.55
Bit, auger, set -- 4 to 16, double leadscrew.	2	8.50
Bit, expansion, 5/8 to 1-3/4 inch capacity.	2	1.85
Brace, bit, 8 inch swing, rachet handle.	4	3.50
Brace, bit, 10 inch swing, rachet handle.	20	4.00
Calipers, inside 8 inch.	3	1.00
Calipers, outside 8 inch.	3	1.00
Countersink bits, rosette type 3/4 inch.	6	.45
Dividers, spring, 8 inch.	6	1.00
Dowel bit.	2	.60
Drill, hand, capacity $\frac{1}{4}$ inch, $3\frac{1}{2}$ inch hand wheel.	4	1.50
File, auger bit, 7 inch.	3	.30
File, half round, cabinet, 12 inches long	6	1.00
File, flat (wood) 10 inches.	6	.47

Name and Description	Quantity	Approximate Unit Price
Gauge, marking, brass face plates.	24	$ .35
Hammer, claw, 10 oz.	24	1.10
Mallet, hickory, 2½ x 6.	24	.43
Mallet, rubber, 2¼ x 4.	3	1.20
Nail set, 1/32, 1/16, 3/32, 4/32, 5/32.	15	.13
Plane, block, 6 inches long, 1½ inch cutter.	24	1.50
Plane, jack, 14 inches long, 2 inch cutter.	24	4.00
Plane, jointer, 22 inches, 2-3/8 inch cutter.	2	6.60
Plane, smooth, 9 inches long, 2 inch cutter.	12	3.60
Rasp, wood, half round, cabinet.	6	1.47
Rule, bench, folding, 24 inch.	24	.58
Saw, back, 10 inch length, 12 pts. to inch.	24	2.35
Saw, coping, 6½ inch pin and blades.	10	.90
Saw, cross cut, 22 inch, 10 pts. to inch.	6	3.00
Saw, rip, 26 inch, 5½ pts. to inch.	6	3.50
Scrapers, cabinet, 4 inch.	6	1.44
Scraper, hand, 4 inch.	6	.60
Screwdriver, 4 inch blade.	12	.74
Screwdriver, 6 inch blade.	12	1.00

Name and Description	Quantity	Approximate Unit Price
Square, framing, body 24 x 2, tongue 16 x 1½.	3	$ 1.60
Square, try, 6 inch blade.	24	.65

(It will be noted that all necessary equipment is not listed. It is the intention to provide the remainder with what is now in the present shop.)

General shop.-- A shop of this type is one of the additional courses to be recommended for the industrial-arts curricula.[4/] It aims for the exploration of interests and abilities in industrial occupations. At present, many students do not have an opportunity to take shop work because of scheduling difficulties. A general shop provides vocational exploratory experiences for those students who only have the minimum time allotment for elective work.

Figure 5, page 40, illustrates the layout for the division of the various types of work. Equipment and benches are so arranged to obtain the maximum natural lighting and to permit ease of operation without interference with fellow students. The method of keeping tools for student use is by means of wall panel tool cabinets. All popular tools should be displayed for easy vision and use.

4/ Sylvan A. Yager, "Shop Planning for the High School", Industrial Arts and Vocational Education. March, 1947. pp. 87-91.

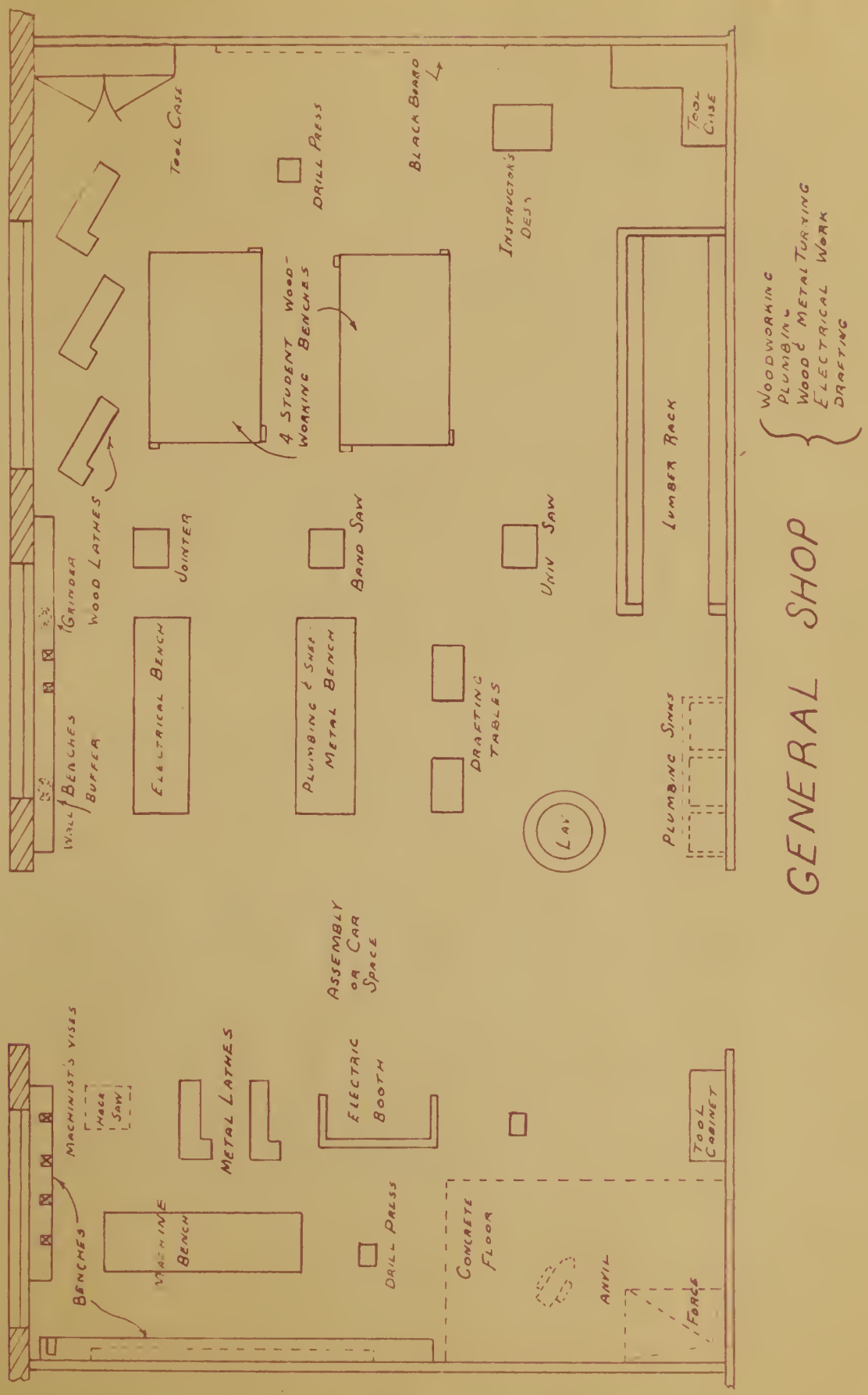

Figure 5 - Proposed Floor Plans for a General Shop.

A list of equipment necessary for a general shop is listed on the following pages.

Name and Description	Quantity	Approximate Unit Price
Woodwork - Power Machines and Accessories		
Glue pot, electric, 2 qt. capacity three-way control.	1	$ 28.00
Jointer, 6 inch, multiple V belt drive, bed length 37 inches, ½ H.P. motor and one knife guard.	1	110.00
Lathe, wood turning distance between centers 38 inches, variable speed drive, tool rest and underneath motor drive.	3	150.00
Drill, electric, one half capacity. Overall length 16-5/8 inches, Complete with stand and motor, operating on AC and DC, 110 volts.	1	110.00
Sander, portable, aluminum	1	99.50
Saw, band, 14 inches, complete with stand and motor, universal type, operating on AC and DC, 110 volts.	1	125.00
Saw, jig, 24 inches x 5 inches, 1/2 H. P. motor, pedestal type	1	82.50
Saw, power, tilting arbor, direct motor drive; including two rip saws, two cross cut saws and one six inch dado head. Complete with motor and all necessary safety guards	1	210.00

Name and Description	Quantity	Approximate Unit Price
Large Equipment		
Benches, woodworking, 6 small drawers and screw vises.	4	$ 90.00
Desk and chair, instructor's, 30 inch x 42 inch desk top.	1	85.00
Small Equipment		
Bar, wrecking, 3/4 inch x 30 inch.	2	.76
Bevel, T, 8 inch blade.	3	.55
Bit, auger, sizes ¼ inch to 1 inch, by 16ths, complete set.	2 sets	8.50
Bit, countersink, 3/4 inch cutting edge.	3	.33
Bit, fostner, set - ¼ inch to 1 inch, by 16ths.	2 sets	3.00
Bit, screwdriver, 3/8 inch.	3	.25
Bit, twist drill, set - 1/8 inch to ½ inch, by 32nds.	1 set	2.00
Brace, ratchet bit, 8 inch sweep.	3	2.25
Caliper, 8 inch outside, screw adj.	2	1.00
Caliper, 8 inch inside, screw adj.	2	1.00
Can, oil, ½ pint capacity.	2	.65
Chisel, wood, set -- 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1¼, 1½, 1-3/4 and 2.	2 sets	9.00
Clamp, bar, 3 ft.	6	3.20
Clamp, bar, 5 ft.	6	4.10
Clamp, "C", 6 inch opening	6	1.30

Name and Description	Quantity	Approximate Unit Price
Clamp, "C", 4 inch opening.	6	$ .95
Dividers, spring, 8 inch.	3	1.00
Drill, Hand, ½ inch capacity.	2	1.90
Gauge, marking, brass face plate.	4	.35
Hammer, claw, 13 oz.	2	1.10
Hammer, claw, 16 oz.	2	1.20
Knife, draw, 10 inch.	1	1.60
Knife, putty, stiff blade.	2	.40
Knife, sloyd.	4	.45
Level, 24 inch.	1	2.50
Mallet, hickory, 2½ x 4.	4	.43
Miter box, 28 inch x 5 inch saw.	1	28.80
Nail set, 4 inch length.	4	.13
Plane block, 6 inches long, 1½ inch cutter.	6	1.50
Plane, jack, 14 inches long, 2 inch cutter.	6	4.00
Plane, smooth, 9 inches long, 2 inch cutter.	6	3.60
Rule, bench, folding, 24 inch.	6	.72
Saw, back, 12 inches long, 14 pts. per inch.	6	2.35
Saw, coping, 6½ inch pin end blades.	3	.90
Saw, cross cut, 22 inch, 10 pts. to inch	3	3.00

Name and Description	Quantity	Approximate Unit Price
Saw, rip, 5½ pts. to inch, 24 inch blade.	3	$ 3.50
Screwdriver, 4 inch blade	3	.74
Screwdriver, 6 inch blade	3	1.00
Square, combination, 12 inch blade.	2	1.50
Square, framing, body 24 inch x 2 inch.	2	1.60
Squre, try, 6 inch blade.	6	.65
Stone, oil, 2 inch x 7 inch, coarse and fine	6	1.75
Wood turning tools, complete set	3 sets	11.00
Mechanical Drawing Equipment		
Board, drawing, 18 inch x 24 inch.	4	1.50
Compass, 6 inch.	2	2.00
Curve, french, #16.	3	.65
Drawing set, complete.	4	16.75
Sharpener, pencil.	1	2.00
Square, "T", 24 inch blade.	4	.65
Table, drawing, drop leaf, 30 inch x 42 inch, 2 student type.	2	45.00
Triangle, 30-60 degrees, 10 inch.	4	.40
Triangle, 45-45 degrees, 8 inch.	4	.40

Name and Description	Quantity	Approximate Unit Price
Machine Shop - Power Machines and Accessories		
Grinder, pedestal, tool rest, water pot, ½ H. P. Motor	1	$ 89.00
Lathe, metal, 13 inch swing, 5 ft. bed, underneath motor and all accessories.	2	600.00
Milling machine, complete with guards, power feeds, arbor and motor.	1	385.00
Press, drill, floor model, 0-½ inch capacity, pilot wheel feed, column 60 inch long, ½ H. P. Motor.	1	150.00
Saw, power hack, floor model, coolant fittings, complete with motor.	1	130.00
Shaper, complete with guards, motor and stand.	1	425.00
Other Equipment		
Bench, work, 27 inch x 9 ft. with lockers	2	95.00
Bench, work, 40 inch x 60 inch, 3 storage shelves	1	95.00
Caliper, spring, inside, 8 inch.	2	1.00
Caliper, spring, outside, 8 inch.	2	1.00
Can, oil, ½ pt. capacity.	2	.65
Can, waste, metal.	1	2.00
Chisel, cold, ½ inch.	2	.20
Chisel, cold, 3/4 inch.	2	.35

Name and Description	Quantity	Approximate Unit Price
Clamp, "C", 4 inch opening.	2	$ .95
Clamp, "C", 6 inch opening.	2	1.30
Dividers, spring, 8 inch.	2	1.00
Dresser, emery wheel	1	.70
Drills, high speed, straight shank, set, 1/8 inch - ½ inch by 64ths.	2 sets	19.35
Drills, high speed, straight shank, set, 1/16 inch - ½ inch by 32nds.	1 set	17.50
Gauge, center.	1	.50
Gauge, screw pitch.	1	1.25
Gauge, tap and drill.	1	2.50
Gauge, thickness.	1	1.60
Goggles, safety.	2	1.50
Hack saw frame, 10 inch, adjustable.	2	.70
Hammer, ball pein, 12 oz.	2	.80
Hammer, ball pein, 16 oz.	1	.85
Hammer, riveting, 12 oz.	1	1.10
Mallet, rawhide, 1½ inch x 3½ inch.	1	.80
Micrometer, 0-½ inch, decimal equivalents, ratchet stop.	2	8.50
Micrometer, 0-1 inch, decimal equivalents, ratchet stop.	1	11.50
Pliers, 6 inch.	2	.40
Pliers, 8 inch.	2	.45

Name and Description	Quantity	Approximate Unit Price
Punch, 3/32 inch.	1	$ .35
Punch, 5/32 inch.	1	.35
Punch, 1/8 inch.	1	.35
Punch, center, 5 inch.	2	.45
Reamer, set, ¼ inch to 1 inch by 16ths.	1 set	24.00
Scale, machinists, 6 inch, 64ths.	2	1.70
Scale, machinists, 12 inch, 64ths.	2	2.00
Screw plate set, with taps and dies, complete with stocks and wrenches.	1 set	18.00
Square, combination, 12 inch blade with center head.	2	6.50
Vise, machinists, 3½ inch jaws.	4	14.58
Wrench, crescent, 8 inch.	2	1.00
Wrench, crescent, 10 inch.	2	1.20
Wrench, moneky, 10 inch.	2	1.50
Sheet Metal		
Large Equipment		
Bar folder, 30 inch, adjustable	1	117.60
Former, sliproll, sheet capacity 36 inch. Bench model.	1	74.46
Rotary machine, combination, 4 sets of rollers.	1	52.40
Shear, squaring, foot power, 36 inch.	1	216.00

Name and Description	Quantity	Approximate Unit Price
Stake, blowhorn, diameter of small end 1½ inch, taper to 3/8 inch, diameter large end 4-3/4 inch, taper to ½ inch.	1	$ 16.00
Stake, beakhorn, flatend tapers, round end tapers.	1	28.75
Awl, scratch.	3	.33
Divider, 8 inch, with lock nut.	3	1.57
Hammer, tinners, setting 12 oz.	2	1.13
Iron, electric soldering, 7/8 inch tip.	1	8.88
Mallet, tinners, 3 inch x 6 inch.	2	.59
Punch, center, 3/8 inch x 4-3/4 inch.	3	.12
Punch, hollow, 3/8 inch, ½ inch, 3/4 inch set.	1 set	1.15
Rule, metal, 18 inch, graduated in 64ths.	2	2.50
Rule, metal, 24 inch, graduated in 64ths.	2	3.00
Stake, double seaming, size each end, 3 inch x 1-3/4 inch, length 29 inch.	1	26.00
Stake holder, 30 inch long, width 8 inch.	1	9.00
Stake, round head, diameter of head 3 inch, length 12½ inch.	1	3.00
Stake square, face 2-3/4 inch x 4½ inch.	1	7.50
Electrical Shop		
Battery, auto, 6 volts.	1	12.30
Bell, door.	6	.42
Burglar alarm, closed circuit.	1	.80

Name and Description	Quantity	Approximate Unit Price
Cell, dry, 1½ volts.	1	$ .33
Compass, magnetic.	1	1.00
Connector box.	6	.07
Generator, motor, ¼ H.P., 110 volts.	1	16.00
Iron, soldering, electric, ½ inch tip.	1	6.96
Pliers, combination, 6 inch.	2	.23
Pliers, combination, 8 inch.	2	.38
Pliers, electrician's.	2	1.76
Screwdriver, electrician's.	2	1.00
Plug, connector.	6	.08
Socket, push.	2	.19
Switch, battery, double throw.	1	.36
Switch, flush toggle.	2	.14
Switch, key socket.	2	.19
Switch, three way flush.	2	.19
Switch, single pole, snap.	2	.40
Transformer, doorbell, primary.	1	.90
Vise, machinist, 3½ inch jaws.	2	14.28
Voltmeter range, 50 volts, 40 amps.	2	1.25
Work bench, 18 ft. x 9 ft.	2	25.00
Work booth, to be constructed.	1	20.00

Forging Equipment

Name and Description	Quantity	Approximate Unit Price
Anvil, 200 lbs. steel face and horn.	1	$ 29.00
Chisel, hot, 1½ inch with 16 inch handle.	2	1.77
Forge, steel, hearth 24 inch x 24 inch.	1	48.00
Fuller, bottom, ½ inch with 16 inch handle.	2	1.40
Hammer, ball pein, 24 oz.	2	.93
Hammer, straight pein, 24 oz.	1	1.48
Hammer, sledge, 8 lbs. with 32 inch handle.	1	2.20
Tongs, curved lip, holds round, 3/8 inch, ½ inch and 3/4 inch, by sets.	1 set	4.40
Tongs, general purpose, length 16 inch.	2	1.60

Machine shop.-- The student electing machine shop for one complete semester (I and II) will be taught the use and care of hand tools. When this basic handwork is completed, the student will be ready to obtain the fundamental knowledge for the use of all the power machinery. This course would provide a general picture of the machine industry which would enable the pupil to acquire the habits and skills to perform simple machine shop operations.

Advanced courses would provide the student in this unit with experiences that would make him proficient in the use

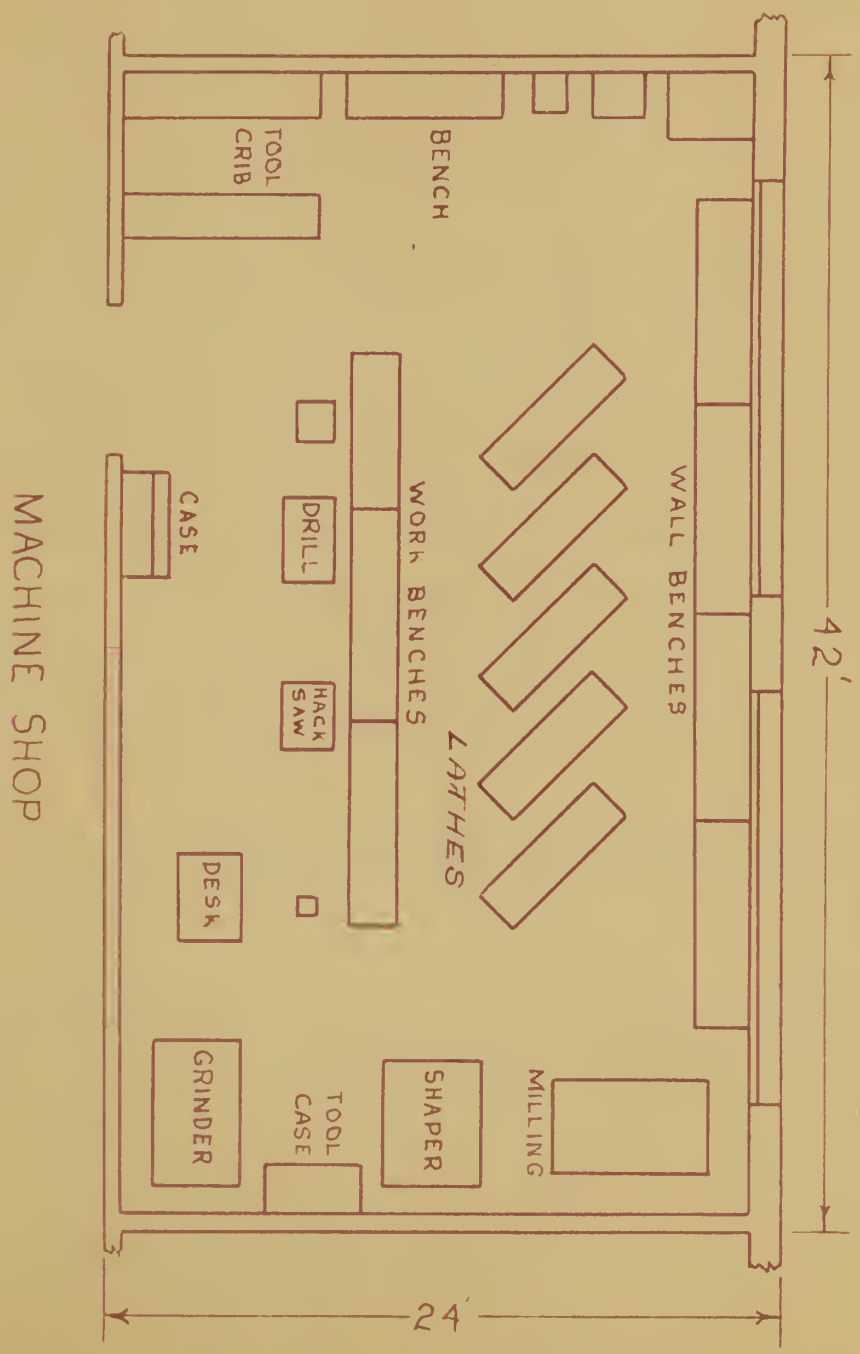

Figure 6 - Proposed Floor Plans for Machine Shop

of lathes and their various attachments. Instruction is to involve set-up work in the milling machine, shaper, grinder, and drill press. Work of this type will involve a high degree of accuracy which develops an appreciation of the machine tools.

The machine shop equipment includes provision for bench work including layout and assembly. Figure 6, page 51, illustrates the position of the lathes, shapers, grinders, drill presses and milling machines. All metal lathes are arranged at an angle to obtain the maximum natural lighting and to permit ease of operation without interference with fellow pupils. The six wall benches will accommodate the various small and portable pieces of bench type equipment.

Following is a list of equipment necessary for a machine shop:

Name and Description	Quantity	Approximate Unit Price
Large Equipment		
Buffer, bench model.	2	$ 9.00
Grinder, pedestal, model-eye shield, tool rest, ½ H.P., 220 volts.	1	105.00
Lathe, metal, 13 inch swing, 5 ft. bed, underneath motor and all accessories	5	600.00

Name and Description	Quantity	Approximate Unit Price
Milling machine, complete with safety guards, power feeds, motor and arbor. Bench model.	2	$385.00
Press, drill, floor model, 0-½ inch capacity, pilot wheel feed, column 60 inch long, ½ H. P. motor.	2	150.00
Saw, power hack, floor model, coolant fittings, complete with motor.	1	130.00
Shaper, complete with guards, motor and stand.	2	425.00
Small Equipment		
Anvil, bench, 100 lbs.	2	20.00
Awl, scratch, ring type.	10	.33
Block, V, plus clamp.	2	3.83
Can, oil, ½ pt., 9 inch bent.	6	.55
Can, waste, automatic, 6 gal.	4	4.00
Caliper, inside, 6 inch, nut construction.	6	1.23
Caliper, outside, 8 inch, nut construction.	6	1.40
Chisel, cold, ½ inch, length 6 inch.	6	.20
Chisel, cold, 3/4 inch, length 7½ inch.	6	.35
Chisel, cold, flat pattern, 3/4 inch.	6	.44
Clamp, "C", 6 inch.	10	1.30
Clamp, "C", 8 inch.	10	1.67
Clamp, "C", 10 inch.	6	3.00

Name and Description	Quantity	Approximate Unit Price
Clamp, tool maker's, parallel length of jaws, 3 inch, opening 2¼ inch.	3	$ 1.40
Combination set, protractor head, center head, square head and rule.	6	10.63
Dividers, forged steel, 6 inch.	6	.88
Dividers, forged steel, 8 inch.	6	1.05
Dresser, emery wheel, two sets of cutters.	1	.78
Drill, carbon steel, st. shank, 1/8 inch - ½ inch by 64ths by sets, 108 drills.	2 sets	8.95
Drill, high speed, taper shank, ¼ inch - 1 inch by 16ths.	2 sets	17.51
Drill, high speed, combination countersink, body diameter 7/16 inch, drill diameter 3/16 inch.	2	1.00
Rule, spring tempered steel, 3/4 inch wide, 6 inch length.	6	1.06
Rule, spring tempered steel, 3/4 inch wide, 12 inch length.	6	1.91
Rule, flexible steel, graduated 32nds, 64ths, 12 inch length.	3	1.91
Square, try, steel, length of blade 4½ inch.	4	.80
Vise, machinist, swivel base, 3¼ inch jaw opening	6	14.28
Wrench, crescent, 8 inch.	4	1.00
Wrench, crescent, 10 inch.	2	1.20
Wrench, monkey, 10 inch.	2	1.50

Name and Description	Quantity	Approximate Unit Price
Wrench, monkey, 12 inch.	2	$ 1.85
Wrench, socket, 10 sockets - 7/16 inch to 1 inch, one handle	1	15.00
Micrometer, 0-1 inch, decimal equivalents, ratchet stop.	6	11.50
Micrometer, 0-½ inch, decimal equivalents, ratchet stop.	6	8.50

Mechanical drawing.-- Figure 7, page 56, illustrates the proposed layout for the mechanical drawing room which has facilities for twenty-four pupils. In addition to the major drawing equipment, a large work table, a blueprinter and a washer is included, thereby offering opportunities for drafting, tracing, and blueprinting. Ample space is provided between benches and the whole room can be viewed with no difficulty. Blackboards are so arranged that students do not have to leave their benches.

The following are units of drawing to be taught: elementary mechanical drawing, sheet metal drawing, machine drawing, tracing and blueprint reading. All units will correlate work with the other shops. Students taking shop courses would develop plans in the drafting periods, directly relative to the activities they are engaged in their respective shop course. This course would allow students

Figure 7 - Proposed Floor Plans for Mechanical Drawing Room

to major in mechanical drawing and also provide a background for an engineering course in a technical college. A list of equipment necessary for a mechanical drawing room is listed on the following pages:

Name and Description	Quantity	Approximate Unit Price
Blue print frame, 11 inch x 16 inch, frame pad glass.	1	$ 13.00
Cabinet, steel filing, outside dimensions, 17-3/4 inch x 26½ inch x 52 inch.	2	38.00
Cabinet, storage, 30 inch x 6 inch x 36 inch high, shelves for paper storage.	2	35.00
Chair, swivel, for instructor's desk.	1	15.00
Cutter, paper, 18 inch x 18 inch.	1	22.00
Desk, instructor's, 4 ft. x 30 inch x 30 inch high, quartered oak top and drawer front.	1	40.00
Developing trays, 30 inch x 42 inch x 6 inch.	2	5.00
Stools, metal, double riveted, steel frame, hardwood seat, 30 inch high, 13½ inch diameter.	24	4.25
Tables, drawing, 28 inch x 30 inch x 40 inch high. Accommodations for drawing boards. Adjustable top to 15 degrees.	24	63.25
Small Equipment		
Compass, wooden	2	1.50

Name and Description	Quantity	Approximate Unit Price
Curves, french, 8 inch, transparent.	12	$ .90
Drawing boards, bass wood, 20 inch x 26 inch.	100	1.85
Drawing board, bass wood, 31 inch x 42 inch.	4	4.00
Pen holder, 7 inch.	24	.10
Protractor, 8 inch.	12	.25
Scale, architect's, box wood, 12 inch.	24	.75
Sharpener, pencil	2	3.25
Square, T, 24 inch, amber edge.	24	3.00
Triangle, 30-60 degrees, 8 inch transparent.	24	.75
Triangle, 45-45 degrees, 8 inch transparent.	24	.85

Automotive shop.-- The automotive shop is recommended as an additional course because of the increase in the use of automobiles which brought with it a demand for auto mechanics. The student would be given a try-out course in the transportation area.

The equipment and layout, illustrated in Figure 8, Page 59, are the minimum essentials in a general automotive course. A course of this type could be called a service course since the emphasis is not upon technical automotive mechanics, but upon the less complicated operations of

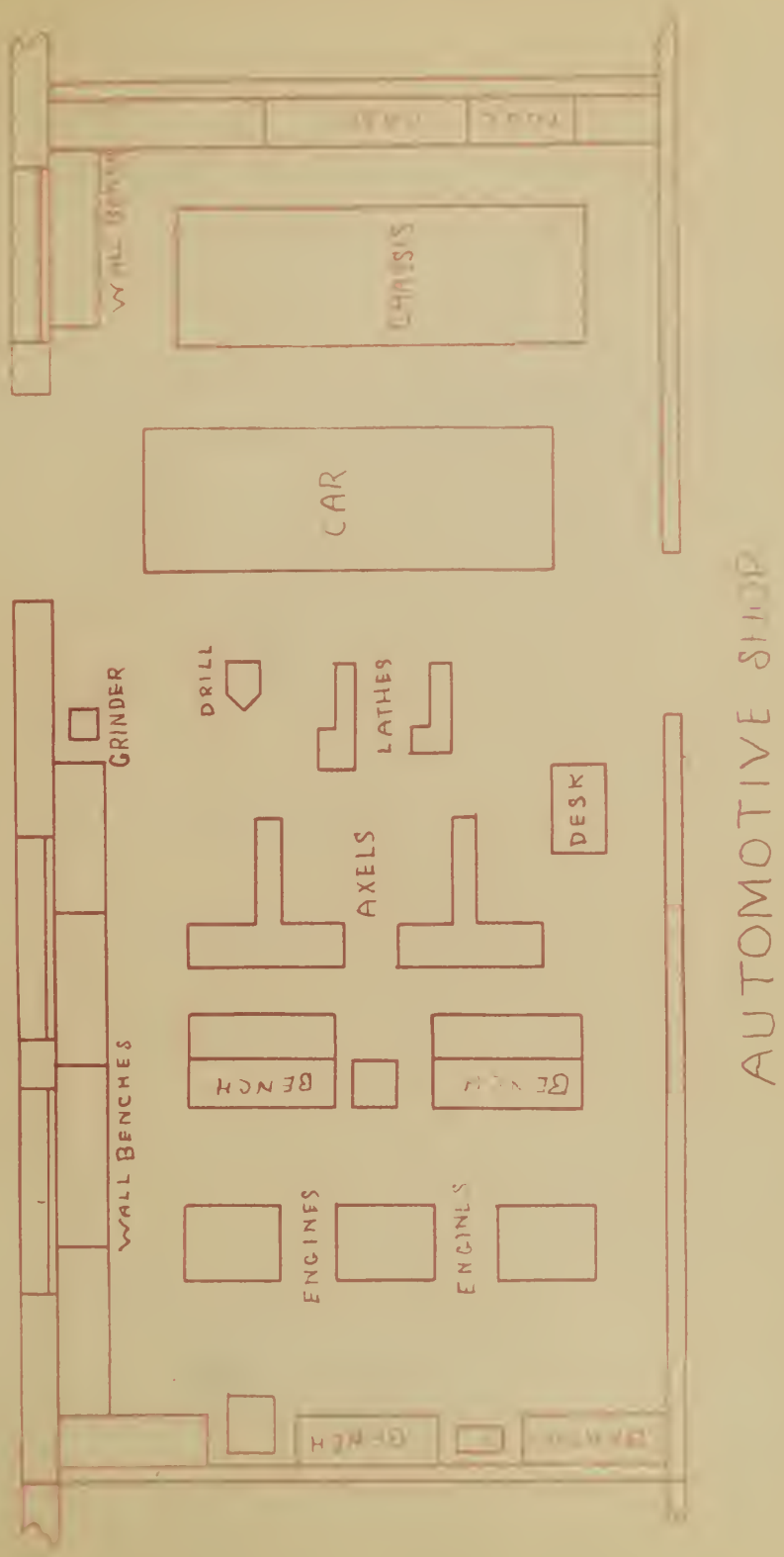

Figure 8 - Proposed Floor Plans for the Automotive Shop.

maintaining and repairing a car. Facilities for the study of aircraft and outboard motor could be made possible in this area. The necessary equipment for an automotive shop is listed:

Name and Description	Quantity	Approximate Unit Price
Large Equipment		
Bench, work, 40 inch x 60 inch.	6	$ 95.00
Differential, Chrysler motor.	1	175.00
Differential, General motor.	1	200.00
Differential, Ford motor.	1	175.00
Drill press, floor model, 0-½ inch capacity, pilot wheel feed, ½ H. P. motor.	1	150.00
Engine, gasoline, 6 cylinder, Pontiac motor.	1	275.00
Engine, gasoline, 6 cylinder, Dodge motor.	1	235.00
Engine, gasoline, 8 cylinder, V-8 Ford motor.	1	300.00
Frame.	1	125.00
Grinder, pedestal, tool rest, water pot, ½ H.P. motor.	1	89.00
Lathe, metal, 13 inch swing, 5 ft. bed, underneath motor and all accessories.	2	600.00
Machine, tune up.	1	350.00
Tool rack, to be constructed.	2	20.00

Name and Description	Quantity	Approximate Unit Price
Transmission	2	$ 150.00
Small Equipment		
Bar, pinch.	2	.85
Chisel, cold, complete set.	1 set	2.50
File, half round, vixen, 10 inch.	4	1.80
File, warding, 4 inch.	4	.72
File, hand, double cut, 10 inch.	3	.54
Hammer, machinist's, 4 oz.	2	.99
Hammer, machinist's, 7 oz.	2	.99
Hammer, machinist's, 9 oz.	2	1.13
Knife, putty.	2	.50
Pliers, auto electrician's, 5 inch.	3	1.54
Pliers, heavy duty, 6 inch.	3	2.00
Pliers, straight nose, 5 inch.	6	.44
Pliers, straight nose, 6 inch.	6	.44
Saw, hack, frame, adjustable.	3	1.95
Screwdriver, automotive, Philips set including 3 inch, 4 inch, 6 inch, 8 inch blades.	2 sets	2.08
Screwdriver, standard, set including $2\frac{1}{2}$ inch, 3 inch, 4 inch, 6 inch, 8 inch, 10 inch blades.	2 sets	2.25
Screwdriver, stubby.	2	.40

Name and Description	Quantity	Approximate Unit Price
Wrench, combination box and open end, complete set.	2 sets	$ 9.65
Wrench, monkey.	2	1.85
Wrench, socket, complete set with tool box.	2 sets	14.98
Wrench, spark plug, complete set.	1 set	2.50

Print shop.-- It is recommended that a printing course be introduced to the high school industrial-arts program. Commerce high school, principally a business training school, would benefit immensely by a shop of this type.

Modern trends in advertising, newspapers and books, and the general make-up of modern business through the use of its many printed forms has made the printing industry a good source for occupational information. In a course of this type the student would not only be given the theoretical training, but also the practical training. The correlation between the classroom and shop would be greatly increased.

Students taking the course for only two semesters would be given introduction to the field of printing. This unit would include elementary composition, simple lock-up, press work, simple binding and silk-screen

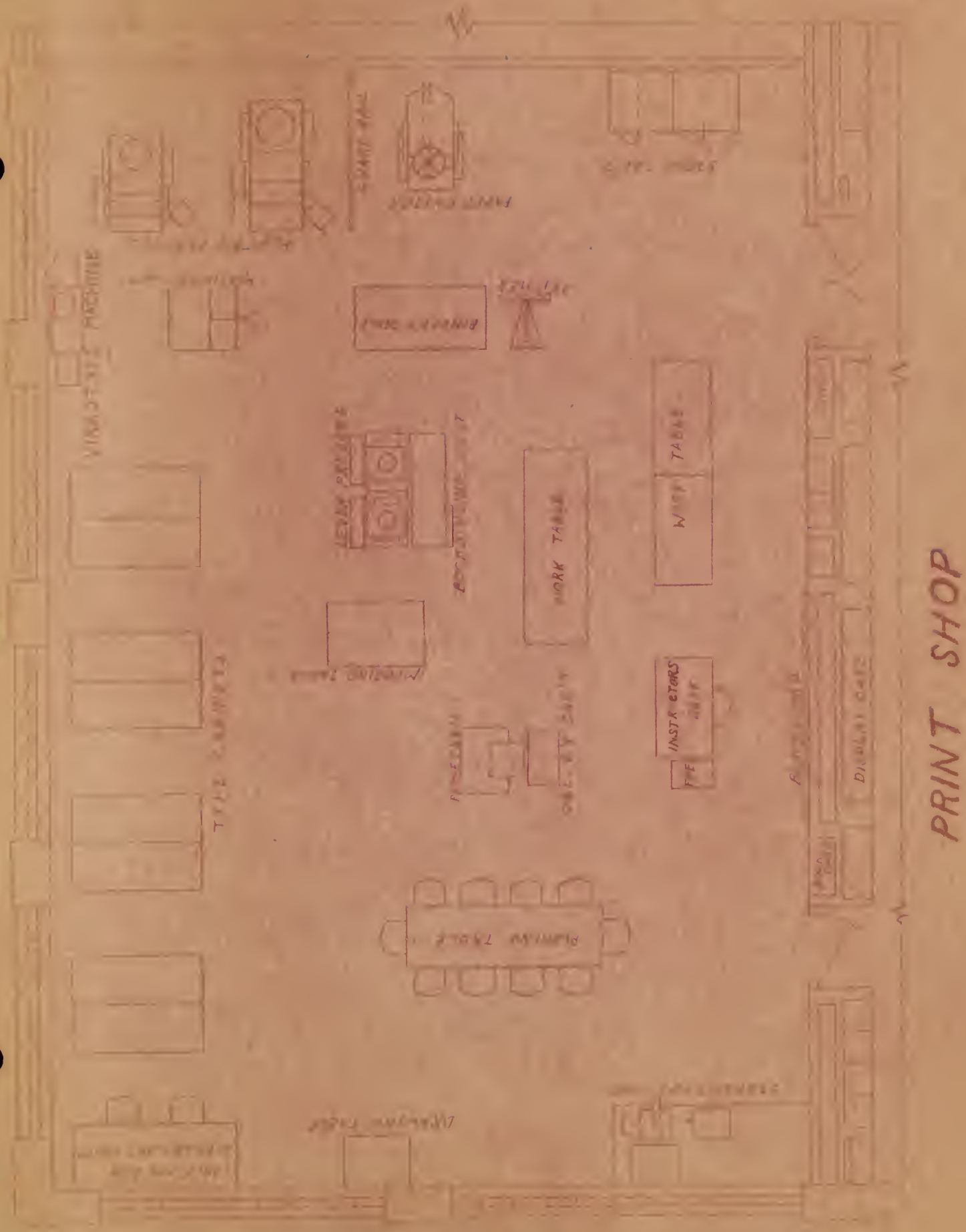

Figure 9 - Proposed Floor Plans for the Print Shop

methods of production. Students taking the course for a longer period of time would make an intensive study of the printing industry and its affiliated fields. This printing program could be entirely concerned with school activities.

Figure 9, page 63, illustrates the floor plan for a print shop which has accommodations for twenty-four pupils. All power machines were placed on one section in order to create an industrial atmosphere. Following is listed the equipment necessary for a print shop:

Name and Description	Quantity	Approximate Unit Price
Large Equipment		
Cabinet, standard type, steel construction, double tier, working bank sloping both ways, height 40½ inch, floor space 38 inch x 6 ft.	6	$ 307.00
Cabinet, pressroom, steel construction. Top 32-7/8 inch x 47 inch, height 40 inch.	1	150.00
Cutter, paper, hand lever including one knife, measuring tape and 4 cutting sticks.	1	573.00
Press, platen, 8 inch x 12 inch with a single disc, combined gear and pinion guard, 6 roller trucks and stocks and 2 wrenches.	1	556.00

Name and Description	Quantity	Approximate Unit Price
Extras for platen press.		
Flywheel guard.	1	$ 3.00
Platen guard.	1	9.40
Press brake.	1	20.50
Motor bracket.	1	46.00
Endless leather belt.	1	8.00
Redington counter	1	9.50
Motor, ½ H.P., pedestal control.	1	100.00
Drip pan.	1	10.00
Press, platen, 12 inch x 18 inch with single disc, combined gear and pinion guard, 6 roller trucks and stocks and 2 wrenches.	1	1,011.00
Extras for platen press (same as 8 inch x 12 inch, but variation in price)		387.50
Press proof, printing surface 13 inch x 18 inch, mounted on metal stand and a cast roller.	1	
Punch, adjustable, hand with 2 solid round-hole dies.	1	60.00
Stitcher, wire, foot power.	1	300.00
Table imposing, steel construction with iron surface 51 inch x 39 inch, drawers, galley units and chase racks	1	563.00
Table drawing, 28 inch x 30 inch x 40 inch high. Top is adjustable to 15 degrees.	1	63.25
Table work, 60 inch x 40 inch x 32 inch high, top 2¼ inch thick, birch construction.	3	62.50
Small Equipment		
Brush, benzine, oval back.	3	.90
Can, storage, gallon size.	1	4.50

Name and Description	Quantity	Approximate Unit Price
Can, benzine, quart size.	2	$ 1.50
Gage, line, 12 inch, pica nonpareil.	2	1.00
Galley, job, 8-3/4 inch x 13 inch, all brass.	2	2.00
Galley, job, 12 inch x 18 inch, all brass.	1	3.50
Galley, pressed steel, 8-3/4 inch x 13 inch.	20	1.25
Pin, spring tongue gage.	12	.10
Stick, composing, 6 inch x 2 inch, stainless steel.	20	5.90
Stick, composing, 10 inch x 2 inch, stainless steel.	2	7.45
Stick, composing, 15 inch x 2 inch, stainless steel.	1	9.35

Type and Spacing Materials

Oldstyle, schoolbook

1 font..... 6 point)
40 lbs..... 8 point)
200 lbs.....10 point)
30 lbs.....12 point)
15 lbs.....14 point) $410.40
20 lbs.....18 point)
2 fonts.....24 point)
1 font.....30 point)

Type and Spacing Materials

Century, Schoolbook Italic

1 font	6 point)	
1 font	8 point)	
1 font	10 point)	
1 font	12 point)	$46.20
1 font	14 point)	
1 font	18 point)	
1 font	24 point)	

Century, Schoolbook Bold

1 font	6 point)	
1 font	8 point)	
1 font	10 point)	
1 font	12 point)	
1 font	14 point)	
1 font	18 point)	$110.00
1 font	24 point)	
1 font	30 point)	
1 font	36 point)	
1 font	48 point)	

Gothic, Heavy Copper plate

1 font	6 point, No. 21)	
1 font	6 point, No. 22)	
1 font	6 point, No. 23)	
1 font	6 point, No. 24)	
1 font	12 point, No. 25)	$29.30
1 font	12 point, No. 26)	
1 font	12 point, No. 27)	
1 font	12 point, No. 28)	
1 font	18 point, No. 29)	
1 font	18 point, No. 30)	

Spaces and Quads

5 lbs.	6 point)	
15 lbs.	8 point)	
60 lbs.	10 point)	
20 lbs.	12 point)	$ 56.00
10 lbs.	14 point)	
10 lbs.	18 point)	
10 lbs.	24 point)	
5 lbs.	30 point)	
5 lbs.	36 point)	
1 font	48 point)	

Name and Description	Quantity	Approximate Unit Price
Type and Spacing Materials		
Leads, 2 point, 5 to 9½ picas . . . . . 2 fonts) Slugs, 6 point, 5 to 9½ picas . . . . . 2 fonts) Leads, 2 point, for cabinets. . . . . 5 fonts) Slugs, 6 point, for cabinets. . . . . 5 fonts)		$ 270.00
Braces and dashes, 10 point	1 lb.	2.00
Fractions, 10 point.	1 lb.	2.00
Leaders, line, 10 point, 4 dots to the em.	5 lbs.	7.25
Parenthesis and brackets.	1 font.	2.00
References, 10 point.	1 lb.	2.00
Spaces, thin, with quarter size case, assortment.	10 lbs.	20.00

Suggested space provisions.-- In a proposed senior high school building program[5/] it is pointed out that Worcester can look forward to the ultimate establishment of four senior high schools caring for Grades IX to XII. These should be thought of primarily as comprehensive high schools, rather than specialized schools, with courses adapted to care for the wants and needs of the majority of youth. Shop facilities should be provided in all schools so that boys

5/ Dr. Henry Linn, "The Survey of the Plant Facilities of the Public Schools of Worcester, Massachusetts," The Institute of Field Studies, Teachers College, Columbia University, New York City. 1949, p. 135.

who wish can learn the fundamentals of woodwork, metal work, home mechanics, drafting, printing and auto mechanics.

For the present, until such a building program is completed, the following space provisions could be made. The provisions could be easily met at this time because of the decrease in high school enrollment.

Commerce High School.-- Reconvert the fourth floor of building #2 into a shop area. This building is a four story, above-basement structure with 36 classrooms. There is an elevator which could be readily used for delivery purposes. The peak enrollment of 1940 was 3,917 and the enrollment in September, 1948, was 2,349.[6/]

North High School.-- This plant has five vacant classrooms and there are three classrooms which are only used one period a day. Under these conditions space is available for shop purposes. This surplus of rooms is contributed to by the decrease in enrollment. The peak enrollment in 1935 was 1,480 and the enrollment in 1948 was 869.

South High School.-- There is one woodworking shop in this school, but more floor space could be obtained because

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6/ Dr. Henry Linn, "The Survey of the Plant Facilities of The Public Schools of Worcester, Massachusetts," The Institute of Field Studies, Teachers College, Columbia University, New York City. 1949, pp. 121-125.

of the decline in enrollment. The peak enrollment in 1935 was 1,132 and in 1948 the enrollment was 917.

Classical High School.-- The basement rooms now used for dining purposes during the noon hour could readily be converted into a shop area. These rooms had been used as academic classrooms when the peak enrollment in 1942 was 1,101. The enrollment in 1948 was 706.

CHAPTER III

SUMMARY AND RECOMMENDATIONS

Summary.-- The success of the industrial-arts program depends to a considerable degree upon the understanding, insight, and general acquaintance which the pupils have of the conditions and relationships which prevail in the industrial world.[1/] Added to this is the fact that the pupil who is the future wage-earner will become a consumer as well as a producer; and that a program for public education which neglects to help individuals consume intelligently and which fails to suggest methods of using leisure time wisely is decidedly undemocratic and short-sighted.

That we are living in a period of profound social change is indisputable. We are moving ever more rapidly from a rural, small-handicraft economy into an industrialized society, with great production, short hours of labor and much leisure.

1/ Edwin A. Lee, Industrial-Arts Education - Objective and Problems of Vocational Education. McGraw and Hill Co., 1938, p. 285.

With such a challenge facing our society, it becomes the duty of the industrial-arts department not only to provide for leisure time activities, but to take into consideration the effects of this mechanized age in which we live. Creative thinking and doing on the part of the individual members of our society which should be encouraged is being crushed by modern inventions such as the radio, television and massive methods of industrial production. All this develops in the individual a lassitude which has even penetrated into the field of literature. For a classic example, one would only have to realize the progress made by pictorial literature which is not only devoured by the youth, but also by the adult as well. To offset this trend, industrial-arts courses in cities of varied industries such as Worcester, Mass., should be organized to include different types of representative experiences chosen from present day industrial fields.

Educators today realize that the schools must assert themselves if they are to counteract the influence of the various other factors that enter into the life of the student. The education given in our schools should adequately prepare the individual to assume his place in society and the curriculum should reflect as far as possible the problems that the student will encounter in

in society. It is impossible for the schools to anticipate each problem to be faced, but it does seem to be within the realm of possibility that the board general principles can be laid down which can serve as guides to the student. The distances separating the school-room from the realities of life can never be completely abolished, but it can be minimized by bringing the curriculum content that is true to life and which will help to develop the attitude, knowledge and skill that are needed for a better social order.

In Chapter II provisions were made for a complete reorganization of the industrial-arts program of Worcester, Mass., and revised courses were recommended, but this would only be the beginning. In order to make a truly effective program, it is highly desirable that the following recommendations be given careful thought by the administrators who are charged with the responsibility of successful and intelligent operation.

Recommendations.-- With the foregoing thoughts in mind, it is suggested:

1. The Guidance program should include on its staff a qualified full-time industrial-arts teacher. Such a person would be well aware of the potentiality of industrial-arts education in a program of this type.

If the guidance program were to be operated by academically minded counselors, industrial-arts would surely be kept in a secondary position. An industrial-arts counselor would recognize the need of boys with mechanical ability who might be better able to profit by more hours in industrial education than by regular courses of study in the regular academic program. Many of the students in our high schools become problem pupils because they resent being closeted in a classroom surrounded by four walls and subjected to monotonous routine in which they have no interest.

2. An attempt should be made to re-educate our academically minded teachers to appreciate and understand the aims and objectives of industrial arts in our secondary curriculum. It is a sad commentary upon our whole system of education that so many engaged in teaching are only concerned with the academic training and consider education in the vocational field as of no importance.

They must be made to realize that the needs of the pupil can be met not only in a manipulative manner, but also in a cultural manner through appreciation gained by creating, designing, and fashioning different

materials into beautiful objects and even delving into the history of tools and materials. It should be clearly understood that administrators and supervisors should be included in this program of re-education. Plans should be drawn up by those in charge so that all teachers, administrators, and supervisors would familiarize themselves with the basic objectives of the curriculum and by frequent visits to the shops would see how these objectives were being attained. This could be worked out as a professional improvement which is required in many school systems.

3. Industrial-arts courses should be taken off the elective list and put on the required list in the first year of high school, since nearly 50% of our high school population leave school either at the legal age of leaving or before the completion of the required four years. Of course, this should not be done until the facilities for industrial-arts become what they should. During this period, the industrial-arts counselor could analyze the interests and abilities of the pupil in manipulative work, and pupils could benefit immensely by actual participation in shop work. It certainly should not be assumed

that all who receive instruction in industrial-arts will go into industries. If properly organized, this program should be liberal enough to help those who can and will continue their school work to choose wisely their more specific courses in higher education, but also give them practical working knowledge and ability in manual skills. The few skills that might be taught would be beneficial in intelligent selection of a life work.

4. There should be more opportunities for correlation between the industrial-arts department and the academic department. Teachers and school leaders fail to see the educational challenge that lies in this direction. Courses in school services which should correlate particularly well with industrial arts include the following: art and design, physical sciences, mathematics, English, vocational and educational guidance, industrial history and geography, and social and economic problems of industry. Within the industrial course itself the related material which is necessary to successful manual achievement should be taught concurrent with the manual instruction. Related knowledge, to develop general industrial intelligence or to understand the

significance of manual things, should be taught within the department. One of the mistakes which is quite common today is the way in which shop teachers emphasize manipulative work and neglect related information.

These desirable educational results cannot be achieved until people of vision are placed in administrative positions. With the backing of the school administration, the teachers may well be charged with the responsibilities of discovering subject matter which may yield superior educational values when correlated. This frequently requires a complete change of attitude, and demands that someone in a responsible position assume or be given a position of leadership in the work.

5. Industrial-arts courses should be made available to girls as well as the boys, since many of its phases are applicable. Girls and women, in operation of the household, the car, communication devices and the garden, are confronted with use, adjustment, and occasional repair of mechanized labor saving devices. Their complete education in home economics is no longer confined to cooking, sewing and cleaning. It is important that they have a knowledge of adjustment

and of simple repairs on electrical, mechanical, plumbing and structural devices.

The nature of the shop work would lead to the development of consumer appreciation. The field of industrial-arts would encourage hobby activities such as metal work, leathercraft, ceramics, photography, drafting and design. Smaller projects such as wood finishing or refinishing, which do not require heavy muscular work, have practical possibilities for later years.

The primary aim of education is preparation for life. Industrial education must deal with the more significant and vital aspects of life as it is today and will be tomorrow.

Date Due

DEC 5	1949	JAN 20	1953
FEB 23	1950	APR 13	1953
FEB 25	1950	DEC 8	1954
MAR 8	1950	AUG 17	1955
APR 1	1950	DEC 10	1953
OCT 18	1950		
JAN 13	1951		
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